

GRAPHICAL SOLUTION

(12 Marks)

Q: $y = x^2 + 7x + 4$
 $(-2)^2 + 7(-2) + 4$

(i) Complete the table below: (1 Mark)

x	-2	-1	0	1	2	3
y	-6	-2	4	12	22	34

LIFE SAVING TIP: Always use brackets while putting values in any equation.

$-2^2 + 7(-2) + 4$	84
$\downarrow$ This is wrong.	-14
$(-2)^2 + 7(-2) + 4$	
$\downarrow$ This is correct	-6

(ii) On a graph draw a smooth curve. (3 Marks)

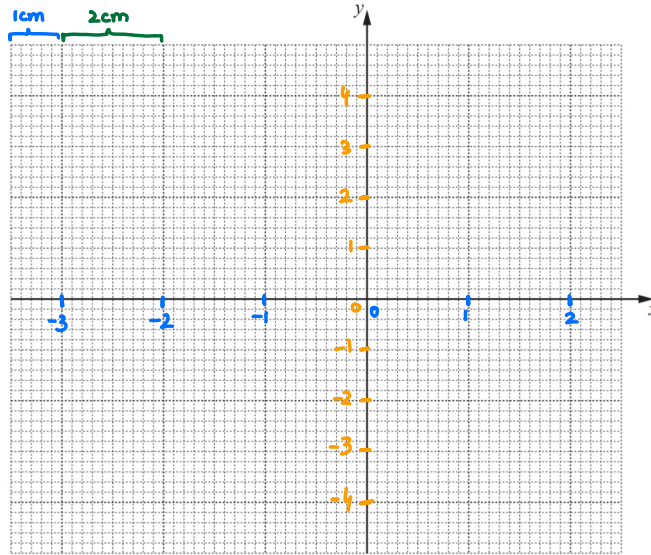
Lets break these three Marks:

1 Mark Scale.

On horizontal axis 2cm represents 1 unit
 1cm represents 1 unit.

5 Small boxes = 1 cm 10 Small boxes = 2 cm

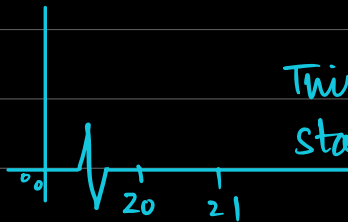
- (a) Using a scale of 2 cm to 1 unit on the x-axis for $-3 \leq x \leq 2$ and a scale of 1 cm to 1 unit on the y-axis for $-4 \leq y \leq 4$, plot the points from the table and join them with a smooth curve.



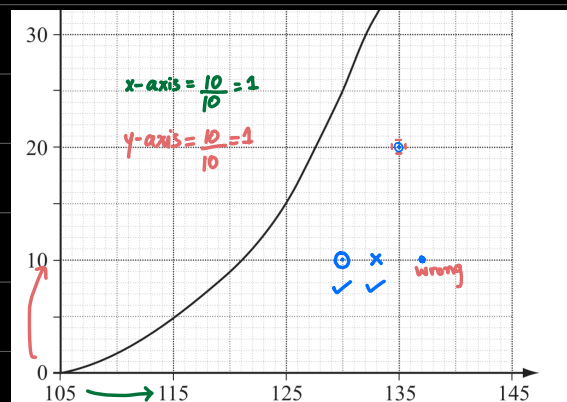
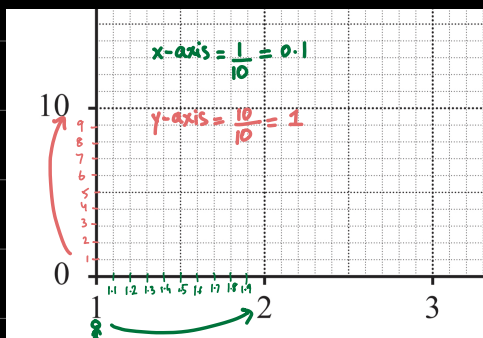
↓
This applies to
all subjects
with graphs.

THIS IS NOT
ALLOWED IN
CAIE
→

Sometimes the scale does not start from zero.



This is wrong way of
starting from another value.



Value of
1 box = $\frac{\text{Jump in value}}{\text{Jump in boxes}}$

IMARK PLOTS



or

x

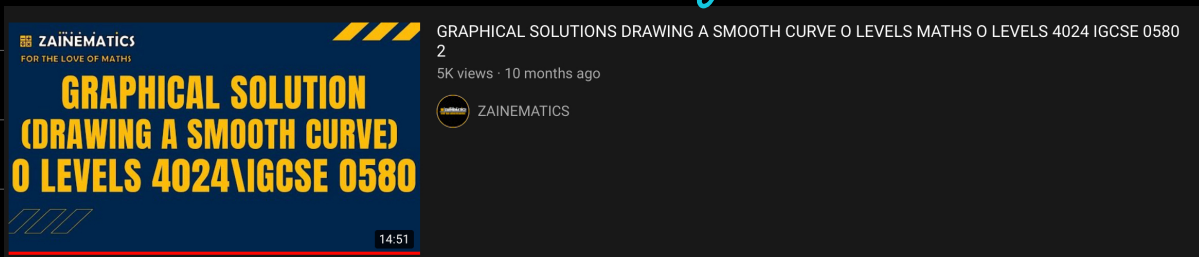
we prefer
doing this.

Do not make a thick dot.

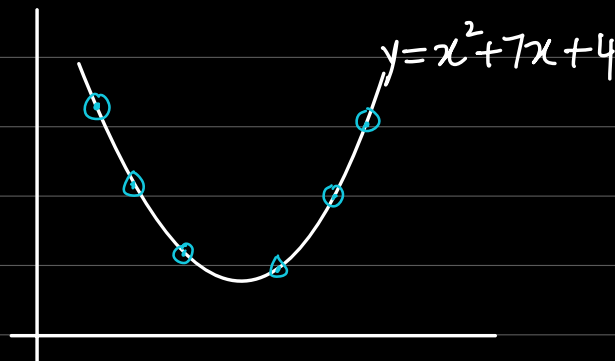
1 Mark Smooth curve.

Three main Basics:

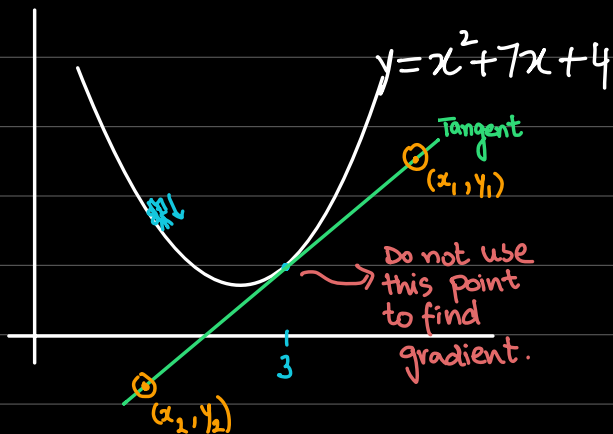
- Pencil grip
- Hand direction
- 5 times fake draw.



Now you will have a graph which
may look like this:



(iii) By drawing a tangent to curve at $x=3$, find gradient of curve. (2 Marks)

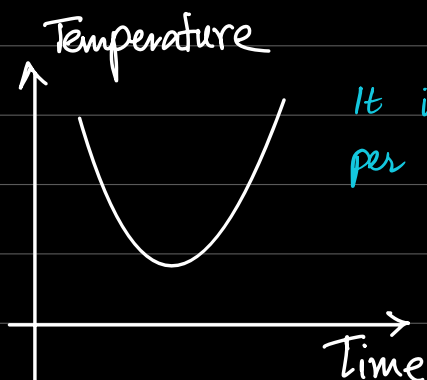


Steps to make a good tangent

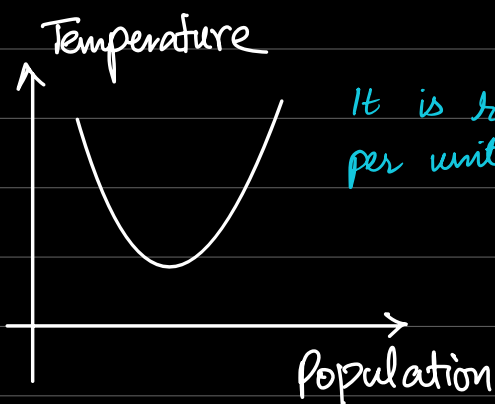
- 1) Grani wali example
Tangent and curve must point in same direction at that point.
- 2) LONGER TANGENTS ARE BETTER.
- 3) Choose two points on tangent FAR AWAY
- 4) Find gradient
$$\text{grad} = \frac{y_2 - y_1}{x_2 - x_1}$$

(iv) What does this gradient represent? (1 Mark)

It is rate of change of y-axis quantity
per unit change in x-axis quantity.



It is rate of change of Temperature ^{y-axis quantity}
per unit change in Time _{x-axis quantity}.



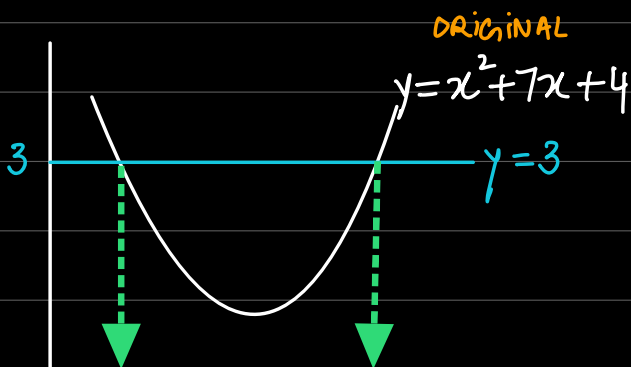
It is rate of change of Temperature ^{y-axis quantity}
per unit change in population _{x-axis quantity}.

HERE ONWARDS, ALL PARTS ARE DIVIDED
IN TWO MAIN CASES:

CASE 1

KEYWORDS: SOLVE FIND THE SOLUTIONS

(v) Using the graph, solve $x^2 + 7x + 1 = 0$
(1 Mark)



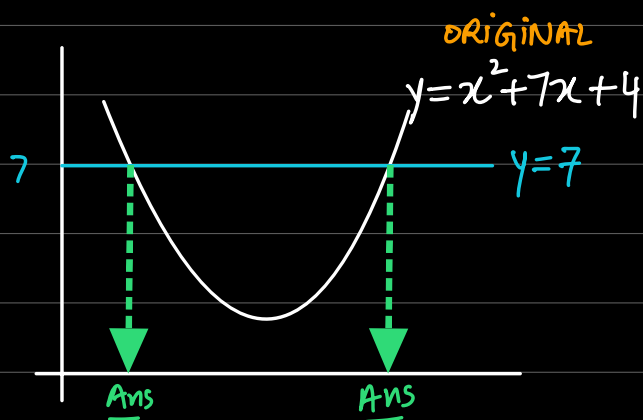
$$\begin{array}{r}
 x^2 + 7x + 1 = 0 \\
 \checkmark \quad \checkmark \quad +3 \quad +3 \\
 \hline
 x^2 + 7x + 4 = 3 \\
 \text{ORIGINAL} \quad \dots
 \end{array}$$

Ans Ans

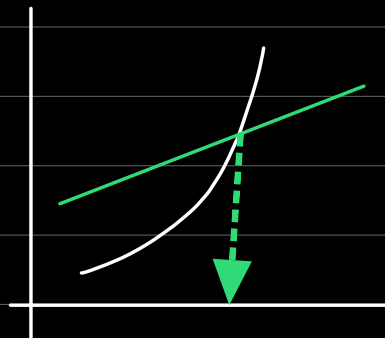
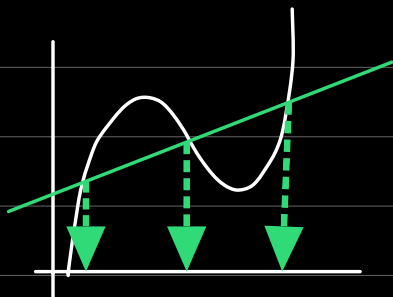
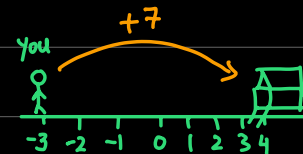
Step 1: Make left hand side equal to original equation
 Step 2: Replace by y
 Step 3: Plot this line on your graph
 Step 4: The x -axis values where the new line cuts the original graph are the final answers

$y = 3$ plot on graph.
 Horizontal

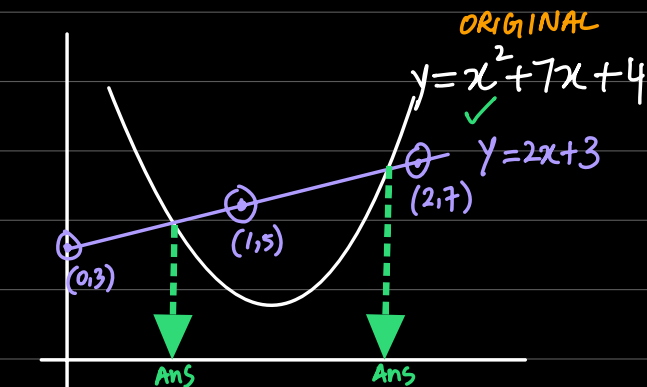
(vi) Find using graph, Solutions of $x^2 + 7x - 3 = 0$ (2 Marks)



$$\begin{array}{r}
 x^2 + 7x - 3 = 0 \\
 \checkmark \quad \checkmark \quad +7 = +7 \\
 \hline
 x^2 + 7x + 4 = 7 \\
 \text{original} \\
 \downarrow \\
 \boxed{y = 7} \text{ plot this.}
 \end{array}$$



(vii) Solve using graph, $x^2 + 5x + 1 = 0$ (2 marks)



To draw a SLANT LINE

$$y = 2x + 3$$

x	0	1	2
y	$2(0) + 3 = 3$	$2(1) + 3 = 5$	$2(2) + 3 = 7$

$$x^2 + 5x + 1 = 0$$

$$+ 2x + 3 = + 2x + 3$$

$$x^2 + 7x + 4 = 2x + 3$$

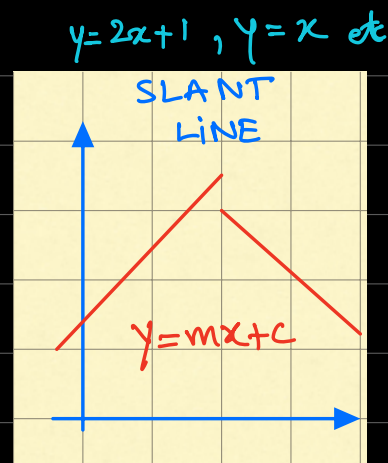
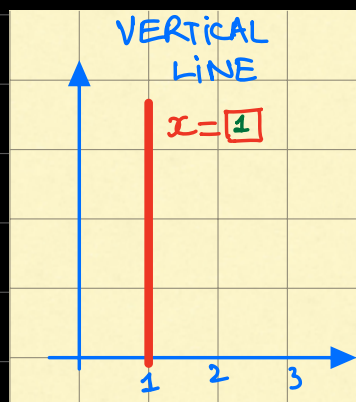
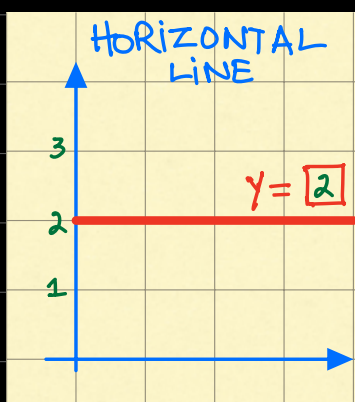
original

$$y = 2x + 3 \quad \text{plot this}$$

Imp. 1) In case 1, x^2 and x^3 terms will always be same.

2) For slant line, make a new box and take three values of x .

THIS IS USED IN 5-CHAPTERS:



- 1- Coordinate geometry.
- 2- Graphical Solutions
- 3- Shading Inequalities

- 4- Transformations
- 5- Kinematics.

CASE 2 KEYWORDS: POINTS OF INTERSECTION
SOLUTIONS

SCARY EQUATION. (NO Y)

(viii) The points of intersection of curve $y = x^2 + 7x + 4$ and line $y = 2x + 5$ are solutions to $Ax^2 + Bx + C = 0$. Find values of A, B and C. (NO Y)

ORIGINAL (curve)
$y = x^2 + 7x + 4$

New (Line)
$y = 2x + 5$

SCARY (NO Y)
$Ax^2 + Bx + C = 0$

Method: Put the equation of curve and line equal.
Simplify and Compare to Scary Equation.

Curve = Line

$$x^2 + 7x + 4 = 2x + 5$$

$$x^2 + 7x - 2x + 4 - 5 = 0$$

$$1x^2 + 5x - 1 = 0$$

$$Ax^2 + Bx + C = 0 \quad (\text{SCARY EQ})$$

$$A=1 \quad B=5 \quad +C=-1$$

$$C=-1$$

(ix) The points of intersection of curve $y = x^2 + 7x + 4$ and line $y = x - 7$ are solutions to $Ax^2 + Bx + C = 0$. Find values of A, B and C. ↓
No y

ORIGINAL (curve)	New (Line)	SCARY (No y)
$y = x^2 + 7x + 4$	$y = x - 7$	$Ax^2 + Bx + C = 0$

Method: Put the equation of curve and line equal.
Simplify and Compare to Scary Equation.
Curve = Line

$$x^2 + 7x + 4 = x - 7$$

$$x^2 + 7x - x + 4 + 7 = 0$$

$$1x^2 + 6x + 11 = 0$$

$$Ax^2 + Bx + C = 0 \quad (\text{SCARY EQ})$$

$$A=1, \quad B=6, \quad C=11$$

Now we know that in Case 2 we have three equation.

BASIC QUESTION:

Curve	Line	SCARY
ALWAYS GIVEN	GIVEN	MISSING

ADVANCED:

Curve	Line	SCARY (No y)
ALWAYS GIVEN	MISSING	GIVEN

↓
 $y = mx + c$

- (x) The points of intersection of the curve $y = x^2 + 7x + 4$ and line L are solutions to $x^2 + 2x - 7 = 0$.
Find equation of line L. ↓ Scary Eq

ORIGINAL (Curve)	New (Line)	SCARY (No y)
$y = x^2 + 7x + 4$	$y = mx + c$	$x^2 + 2x - 7 = 0$

Method: Put the equation of curve and line equal.
Simplify and Compare to Scary Equation.
Curve = Line

$$x^2 + 7x + 4 = mx + c$$

$$x^2 + 7x - mx + 4 - c = 0$$

$$x^2 + (7-m)x + 4-c = 0$$

$$x^2 + 2x - 7 = 0 \quad (\text{SCARY EQ})$$

$$(7-m)x = 2x \quad \< \quad 4-c = -7$$

$$7-m=2$$

$$7=m+2$$

$$m=5$$

$$4=c-7$$

$$4+7=c$$

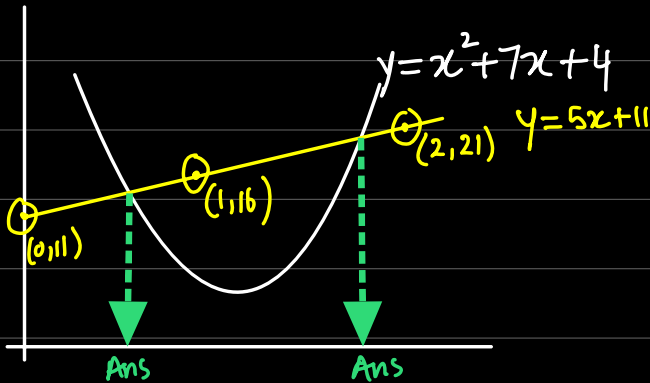
$$c=11$$

Line L:

$$y=mx+c$$

$$y=5x+11$$

(xi) Hence solve $x^2+2x-7=0$.
SCARY EQ



$$y = 5x + 11 \quad (\text{SLANT})$$

x	0	1	2
y	11	16	21

After Case 2, you will always be asked to solve SCARY EQUATION. Do not try to use Case 1.

Step 1: Plot line L from last part on graph.

Step 2: x-axis values where new line L cuts original graph are solution of SCARY equation.